ANGLO-CHINESE JUNIOR COLLEGE
DEPARTMENT OF CHEMISTRY
Preliminary Examination

CHEMISTRY **8873/01**
Higher 1

Paper 1 Multiple Choice

29 August 2018
1 hour

Additional Materials: Multiple Choice Answer Sheet
Data Booklet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, index number and tutorial class on the Answer Sheet in the spaces provided unless this has been done for you.

There are **thirty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
The use of an approved scientific calculator is expected, where appropriate.

This document consists of **12** printed pages.

8873/01/Prelim/18
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ANGLO-CHINESE JUNIOR COLLEGE
Department of Chemistry

[Turn over

1 *Use of the Data Booklet is relevant to this question.*

Which of the following statements is **incorrect**?

A   35.5 g of chlorine gas contains 6.0×10^{23} chlorine atoms.

B   24 dm^3 of hydrogen gas at 20 °C and 1 atm contains 1.2×10^{24} hydrogen atoms.

C   500 cm^3 of 1 mol dm^{-3} aqueous magnesium nitrate contains 3.0×10^{23} nitrate ions.

D   4 g of helium gas contains 6.0×10^{23} helium atoms.

2   Wines often contain a small amount of sulfur dioxide that is added as a preservative. The sulfur dioxide content of a wine is found by the following method:

A 50 cm^3 sample of white wine reacted with 40.0 cm^3 of 0.01 mol dm^{-3} aqueous iodine. The sulfur dioxide in the wine is oxidised to sulfate, SO_4^{2-}, in the process.

$$SO_2 + I_2 + 2H_2O \longrightarrow SO_4^{2-} + 2I^- + 4H^+$$
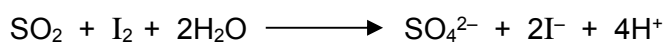
The unreacted iodine requires exactly 23.60 cm^3 of 0.02 mol dm^{-3} sodium thiosulfate, $Na_2S_2O_3$, for complete reaction.

What is the concentration of sulfur dioxide, in mol dm^{-3}, in the wine?

A 1.64×10^{-4}
B 3.28×10^{-3}
C 4.72×10^{-3}
D 9.44×10^{-3}

3   *Use of the Data Booklet is relevant to this question.*

$^{243}_{94}$Pu can undergo natural radioactive decay, where one of its electrons enters the nucleus to change a proton into a neutron, to form a new element **M**.

When **M** is put in an ionisation chamber, it emits a high energy α-particle (which is a ^{4}He nucleus).
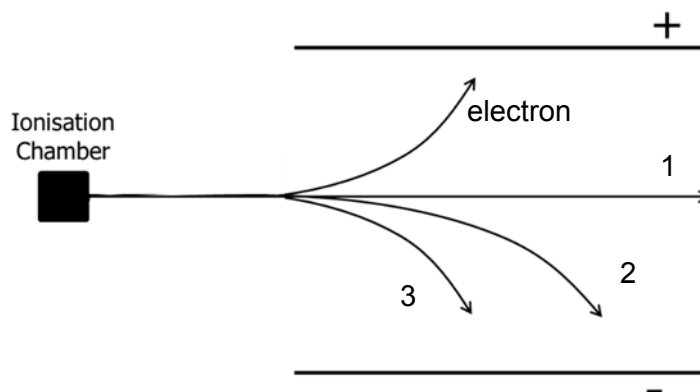

What is the identity of the element **M** and the path of the emitted α-particle in an electric field?

	chemical symbol of **M**	path of α–particles
A	$^{243}_{93}$**M**	2
B	$^{243}_{95}$**M**	1
C	$^{244}_{93}$**M**	2
D	$^{244}_{95}$**M**	3

4   Which of the following species has more protons than neutrons, and more electrons than protons?

A   He$^+$

B   CO

C   OH$^-$

D   F$^-$

5 Trimethoprim (TMP) is used for the treatment of urinary tract infections. It has the following structure:
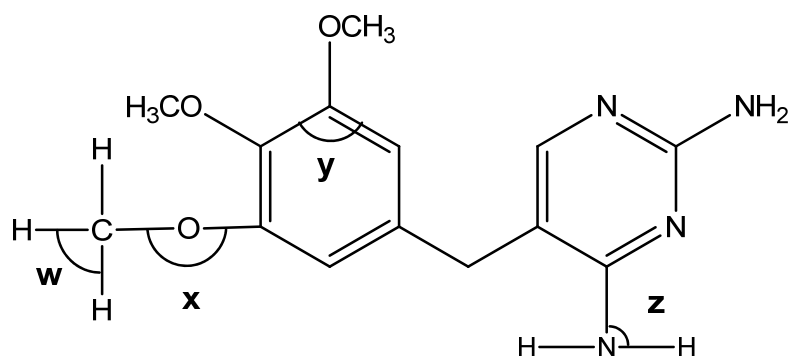
In which sequence are the bond angles **w**, **x**, **y** and **z** quoted in decreasing order?

A   **y > w > z > x**

B   **x > z = y > w**

C   **y > w > x > z**

D   **x > z > y > w**

6 What is the reason of the difference in bond angle in the molecule of ammonia and water?

A   the number of lone electron pairs in the molecule

B   a bonding electron pair having greater repulsive force than a lone electron pair

C   a greater repulsion between the hydrogen atoms in the longer N–H bond length

D   a greater repulsion between the hydrogen atoms in the shorter O–H bond length

7 When 1.50 g of propan–1,2,3–triol, $C_3H_8O_3$, (M_r = 92.0) was burnt, it was found that 100 g of water was heated from 25 °C to 67 °C. This process was found to have an efficiency of 80%.

What is the magnitude for the enthalpy change of combustion of propan–1,2,3–triol in kJ mol^{-1}?

The specific heat capacity of water is 4.2 J g^{-1} K^{-1}.

A 866

B 879

C 1350

D 1370

8 Phosphine reacts with hydrogen iodide to form phosphonium iodide in the reaction shown.

$$PH_3(g) + HI(g) \longrightarrow PH_4^+I^-(s) \qquad \Delta H = -101.8 \text{ kJ mol}^{-1}$$
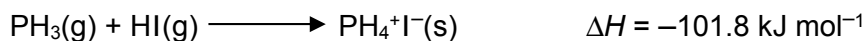
Given that ΔH_f for PH_3 = +5.4 kJ mol^{-1}, and ΔH_f for HI = +26.5 kJ mol^{-1}, what is the standard enthalpy change of formation of phosphonium iodide?

A -133.7 kJ mol^{-1}

B -69.9 kJ mol^{-1}

C +133.7 kJ mol^{-1}

D +69.9 kJ mol^{-1}

**9** The table shows the charge and radius of each of six ions.

Ion	J^+	L^+	M^{2+}	X^-	Y^-	Z^{2-}
radius / nm	0.14	0.18	0.15	0.14	0.18	0.15

The ionic solids **JX**, **LY** and **MZ** are of the same lattice type.

What is the correct order of their lattice energies, placing the least exothermic first?

A JX, LY, MZ

B JX, MZ, LY

C LY, JX, MZ

D LY, MZ, JX

10 The graph shows the results of an investigation of the initial rate of hydrolysis of maltose by the enzyme amylase. In the experiments, the initial concentration of maltose is varied but that of amylase is kept constant.
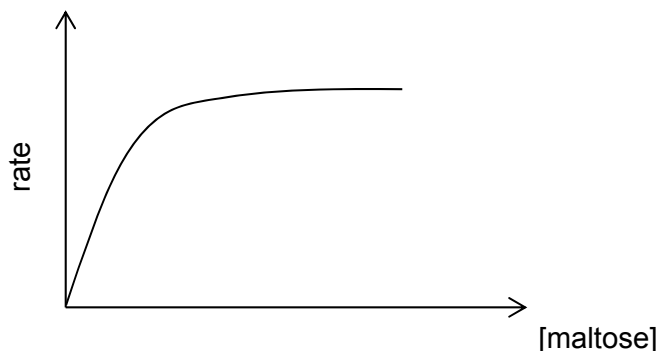

Which of the following **cannot** be deduced from the above information?

1 When [maltose] is low, the rate is first order with respect to maltose.

2 When [maltose] is high, the rate is zero order with respect to maltose.

3 When [maltose] is high, the rate is zero order with respect to amylase.

A 2 only   **B** 3 only   **C** 1, 2 and 3   **D** 1 and 2 only

11 The decomposition $2N_2O_5 \longrightarrow 4NO_2 + O_2$ is first order with respect to N_2O_5.

In an experiment, 0.10 mol of pure N_2O_5 was in an evacuated flask. It was found that there was 0.025 mol of N_2O_5 left after x minutes.

Which of the following statement is true?

A The half–life of N_2O_5 is $\dfrac{x}{2}$ minutes.

B The time taken for 0.20 mol of N_2O_5 to reduce to 0.10 mol is x minutes.

C The half-life is not constant for the decomposition of 0.40 mol of N_2O_5.

D There was 0.0125 mol of N_2O_5 left after 2x minutes.

12 A catalytic converter is part of the exhaust system of modern cars.
Which reaction does **not** occur in a catalytic converter?

A $2C_xH_y + (4x + y)NO \longrightarrow 2xCO_2 + yH_2O + (2x + \frac{y}{2})N_2$

B $C_xH_y + (x + \frac{y}{4})O_2 \longrightarrow xCO_2 + \frac{y}{2}H_2O$

C $2CO + 2NO \longrightarrow 2CO_2 + N_2$

D $CO_2 + NO \longrightarrow CO + NO_2$

13 Which of the following statements is true about dynamic equilibrium?

    A   All of the reactants are used up.

    B   The reactants have stopped reacting.

    C   The concentrations of the reactants and products are equal.

   **D**   The rate of the forward reaction is equal to the rate of the backward reaction.

14 An equilibrium can be represented by the following equation:

$$\textbf{P}(aq) + \textbf{Q}(aq) \rightleftharpoons 2\textbf{R}(aq) + \textbf{S}(aq)$$
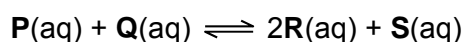
The total volume of the reaction mixture is 1 dm^3 and the equilibrium concentration of **Q** is 0.8 mol dm^{-3}.

What will the new equilibrium concentration of **Q** be if 0.4 moles of **Q** is completely dissolved in the mixture?
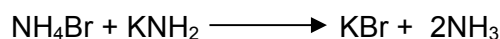
    A   1.2 mol dm^{-3}

    B   between 0.8 mol dm^{-3} and 1.2 mol dm^{-3}

    C   0.8 mol dm^{-3}

    D   between 0.4 mol dm^{-3} and 0.8 mol dm^{-3}

15 Propanoic acid is used in baked products to inhibit the growth of mould. Propanoic acid, when dissolved in water, dissociates according to this equation:

$$CH_3CH_2CO_2H(aq) \rightleftharpoons CH_3CH_2CO_2^-(aq) + H^+(aq)$$
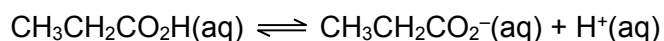
Which of the following statement about propanoic acid is correct?

    A   Adding NaOH will have no effect on the amount of propanoic acid that is dissociated.

    B   0.1 mol dm^{-3} of propanoic acid will have a pH of 1.

    C   The Brønsted-Lowry conjugate base of propanoic acid is the $CH_3CH_2CO_2^-$ ion.

    D   Increasing the concentration of propanoic acid will increase the K_c value.

16 Under appropriate conditions, NH_4Br and KNH_2 react as follows:

$$NH_4Br + KNH_2 \longrightarrow KBr + 2NH_3$$

How is the reaction best classified?

A disproportionation

B acid-base

C redox

D condensation

17 The ionic product of water, K_w at $10\,°C$ is $2.93 \times 10^{-15}\,mol^2\,dm^{-6}$.

What is the pH of a solution containing $0.02\,mol\,dm^{-3}$ of strong base $Ba(OH)_2$ at $10\,°C$?

A 12.6 **B** 12.9 **C** 13.1 **D** 13.3

18 Given that a $0.500\,mol\,dm^{-3}$ of HNO_2 solution has a K_a value of 7.1×10^{-4}, what is the percentange of **undissociated** HNO_2 molecules?

$$HNO_2 \rightleftharpoons H^+ + NO_2^-$$

A 1.88 % **B** 3.77 % **C** 96.2 % **D** 98.1 %

19 Which of the following oxide is unlikely to react with aqueous sodium hydroxide?

A magnesium oxide

B aluminium oxide

C phosphorus pentoxide

D sulfur trioxide

20 Which of the following elements form an oxide with a giant covalent structure and a chloride which is readily hydrolysed?

A magnesium

B sodium

C phosphorus

D silicon

21 Which statements are true about the elements in Group 1 of the Periodic Table?

1 Their ionic radii increase down the group.

2 They are reducing agents.

3 Their electronegativities decrease down the group.

A 2 and 3 only **B** 1 and 3 only **C** 1, 2 and 3 **D** 1 only

22 Which statements about Group 17 elements and the hydrogen halides are correct?

1 Thermal stability of hydrogen halides decreases down the group.

2 Oxidising power of the halogens decreases down the group.

3 Iodine is insoluble in organic solvents.

A 2 and 3 only **B** 1 and 2 only **C** 1, 2 and 3 **D** 1 only

23 Which compound reacts with its oxidised product (an oxidation which involves no loss of carbon) to give a sweet-smelling liquid?

A propanal

B propanoic acid

C propanone

D propan-1-ol

**24** Which property does the compound produced by the addition of liquid bromine to propene have?

1 It can exist as a pair of cis-trans isomers.

2 It possesses permanent dipole-permanent dipole interactions between molecules.

3 It is planar.

A 2 only **B** 1 and 3 only **C** 1, 2 and 3 **D** 3 only

25 Why does the reaction $CH_3CH_2X + OH^- \rightarrow CH_3CH_2OH + X^-$ take place more rapidly in aqueous solution when X is changed from Br to I?

A The I^- ion is a stronger reactant than the Br^- ion.

B The I^- ion is less hydrated than the Br^- ion.

C The C−Br bond is more polar than the C−I bond.

D The C−Br bond is stronger than the C−I bond.

26 Which one of the following pairs of compounds might be made to combine together under suitable conditions to form a polyamide?

A a mono-amine and a monocarboxylic acid

B a diamine and a monocarboxylic acid

C a diamine and a dicarboxylic acid

D a mono-amine and a dicarboxylic acid

27 Polymerisation of chloroethene gives poly(vinyl chloride) or PVC.

How does the carbon-carbon bond in PVC compare with that of chloroethene?

A longer and stronger

B longer and weaker

C shorter and stronger

D shorter and weaker

28 Which monomer co-polymerises with
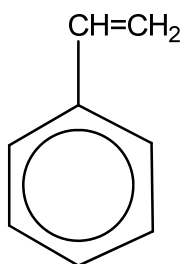
CH=CH₂

to give a polymer with the repeat unit shown below?

$\left(\!-CH-CH_2-CH_2-CH=CH-CH_2-\!\right)$

A
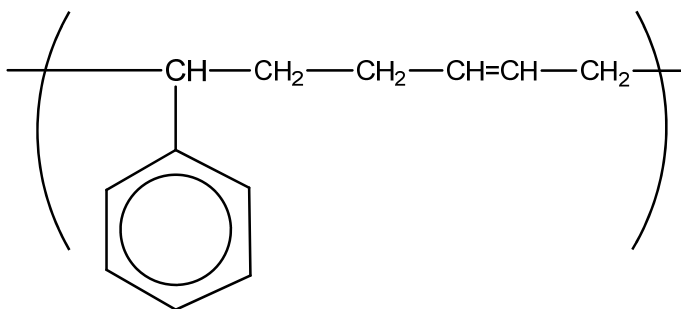
$$H_3C-\underset{\underset{CH_3}{|}}{C}=CH_2$$

B $CH_3-CH=CH-CH_3$

C $CH_2=CH-CH_2-CH_3$

D $CH_2=CH-CH=CH_2$

29 Which of the following statements are **incorrect**?

1 Graphene has low tensile strength.

2 Geckos are able to stick to walls as they form strong covalent bonds to the walls.

3 Catalytic converters have a honeycomb structure to maximize the surface area available for catalysis to take place.

A 1 and 2 only **B** 1 and 3 only **C** 1, 2 and 3 **D** 1 only

30   What is the maximum size, in at least one dimension, of a nanomaterial?

A 1×10^{-6} m

B 1×10^{-7} m

C 1×10^{-8} m

D 1×10^{-9} m